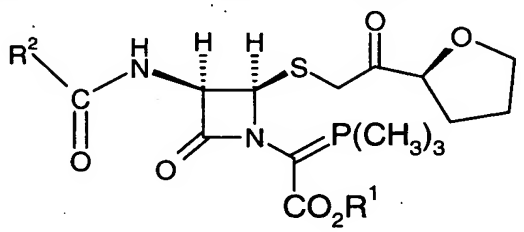
a) ~~heating~~ cyclizing a trimethylphosphinic compound of formula **(IIIa)**



(IIIa)

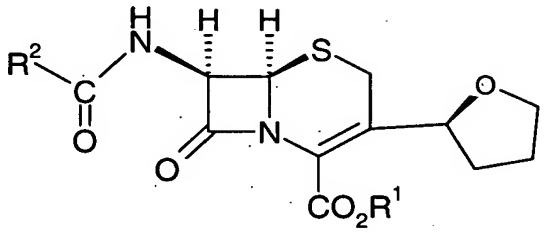
wherein

R^1 is *para*-nitrobenzyl or allyl;

R^2 is selected from the group consisting of C_{1-6}alkyl, C_{6-10}aryl, C_{6-10}arylC_{1-6}alkyl and dithianyl;

in a solvent;

to form a compound of formula **(II)**



(II)

wherein

R^1 is *para*-nitrobenzyl or allyl;

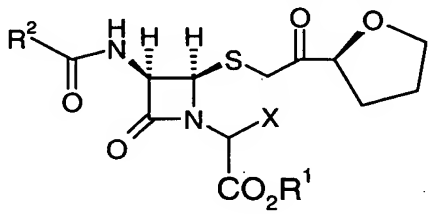
R^2 is selected from the group consisting of C_{1-6}alkyl, C_{6-10}aryl, C_{6-10}arylC_{1-6}alkyl and dithianyl; and

b) reacting said compound of formula **(II)** with ~~an~~ a Lewis acid of structure PX_5 wherein X is a halo group.

2. (ORIGINAL) A process according to claim 1, wherein said solvent is selected from the group consisting of toluene, xylene, tetrahydrofuran, methylene chloride and acetonitrile.

3. (ORIGINAL) A process according to claim 1, wherein said acid is phosphorus pentachloride or phosphorus pentabromide; and wherein X is chloro or bromo.

4. (ORIGINAL) A process according to claim 1, further comprising the step of preparing said compound of formula **(IIIa)**, by reacting a compound of formula **(IIIb)**



(IIIb)

wherein said R^1 is *para*-nitrobenzyl or allyl,

said R^2 is selected from the group consisting of C_{1-6}alkyl, C_{6-10}aryl, C_{6-10}arylC_{1-6}alkyl and dithianyl; and

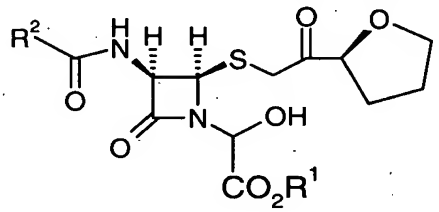
said X is halo;

with trimethylphosphine, in a solvent and in the presence of a base.

5. (ORIGINAL) A process according to claim 4, wherein said solvent is tetrahydrofuran, acetonitrile or methylene chloride.

6. (ORIGINAL) A process according to claim 4, wherein said base is selected from the group consisting of imidazole, 2,6-lutidine, pyridine, N-methylmorpholine and sodium bicarbonate.

7. (ORIGINAL) A process according to claim 4, further comprising the step of preparing said compound of formula **(IIIb)**, by reacting a compound of formula **(IIIc)**



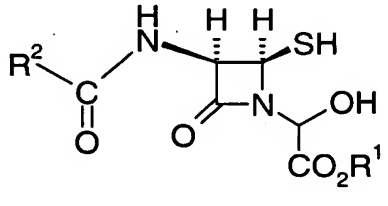
(IIIc)

wherein said R^1 is *para*-nitrobenzyl or allyl and said R^2 is selected from the group consisting of C_{1-6}alkyl, C_{6-10}aryl, C_{6-10}arylC_{1-6}alkyl and dithianyl; with a halogenating agent, in a solvent and in the presence of a base.

8. (ORIGINAL) A process according to claim 7, wherein said halogenating agent is thionyl chloride, thionyl bromide, phosphorus trichloride or phosphorus tribromide; and said halo is chloro or bromo.

9. (ORIGINAL) A process according to claim 7, wherein said base is selected from the group consisting of pyridine, 2,6-lutidine, N-methylmorpholine and imidazole.

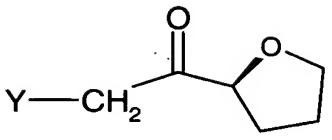
10. (ORIGINAL) A process according to claim 7, further comprising the step of preparing said compound of formula **(IIIc)**, by reacting a compound of formula **(V)**



(V)

wherein said R^1 is *para*-nitrobenzyl or allyl and said R^2 is selected from the group consisting of C_{1-6}alkyl, C_{6-10}aryl, C_{6-10}arylC_{1-6}alkyl and dithianyl;

with a compound of formula **(IV)**



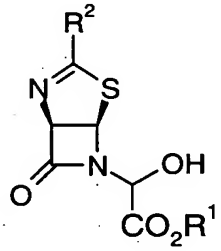
(IV)

wherein Y is a leaving group selected from the group consisting of bromo, chloro, fluoro, iodo and tosylate; in a solvent.

11. (ORIGINAL) A process according to claim 10, wherein said Y is bromo or chloro.

12. (ORIGINAL) A process according to claim 10 wherein said solvent is alcohol selected from the group consisting of methanol, ethanol and propanol; methylene chloride; acetone; dimethylformamide or mixtures thereof.

13. (ORIGINAL) A process according to claim 10, further comprising the step of preparing said compound of formula (**V**) by reacting a compound of formula (**VIa**)



(VIa)

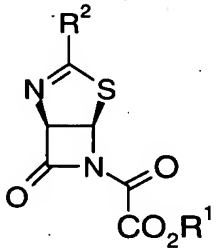
wherein R^1 is *para*-nitrobenzyl or allyl and wherein R^2 is selected from the group consisting of C_{1-6}alkyl, C_{6-10}aryl, C_{6-10}arylC_{1-6}alkyl and dithianyl; with an acid in a solvent.

14. (ORIGINAL) A process according to claim 13 wherein said acid is *para*-toluene sulfonic acid or methane sulfonic acid.

15. (ORIGINAL) A process according to claim 13 wherein said solvent is methylene chloride, tetrahydrofuran, acetone or mixtures thereof.

16. (ORIGINAL) A process according to claim 13 further comprising the step of preparing said compound of formula (**VIa**) by:

reacting a compound of formula (**VIb**)



(VIb)

wherein

R^1 is *para*-nitrobenzyl or allyl;

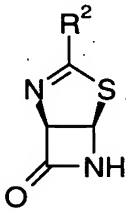
R^2 is selected from the group consisting of C_{1-6}alkyl, C_{6-10}aryl, C_{6-10}arylC_{1-6}alkyl and dithianyl;

with a reducing agent selected from the group consisting of sodium borohydride, sodium cyanoborohydride, borane and sodium triacetoxy borohydride; in a solvent.

17. (ORIGINAL) A process according to claim 16 wherein said reducing agent is sodium triacetoxy borohydride.

18. (ORIGINAL) A process according to claim 16 wherein said solvent is acetic acid, methylene chloride, tetrahydrofuran, isopropanol or mixtures thereof.

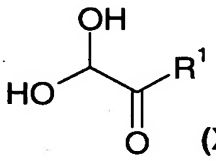
19. (ORIGINAL) A process according to claim 13 further comprising the step of preparing said compound of formula **(VIa)** by reacting a compound of formula **(XI)**



(XI)

wherein R^2 is selected from the group consisting of $C_{1\text{-}6}$alkyl, $C_{6\text{-}10}$aryl, $C_{6\text{-}10}$aryl$C_{1\text{-}6}$alkyl and dithianyl;

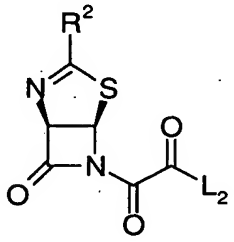
with a compound of formula **(X)**



(X)

wherein R^1 is *para*-nitrobenzyl or allyl; in a solvent; in the presence of a base.

20. (ORIGINAL) A process according to claim 16 further comprising the step of preparing said compound of formula **(VIb)** comprising reacting a compound of formula **(VIII)**



(VIII)

wherein

R^2 is selected from the group consisting of $C_{1\text{-}6}$alkyl, $C_{6\text{-}10}$aryl, $C_{6\text{-}10}$aryl$C_{1\text{-}6}$alkyl and dithianyl;

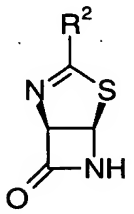
L_2 is a leaving group selected from the group consisting of halo, azide and $C_{1\text{-}6}$alkoxy;

with a compound of formula **(VII)**

$$R^1\text{—OH} \qquad \textbf{(VII)}$$

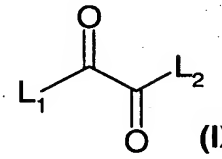
wherein R^1 is *para*-nitrobenzyl or allyl, in a solvent, in the presence of a base;

further comprising the step of preparing said compound of formula **(VIII)** by reacting a compound of formula **(XI)**



(XI)

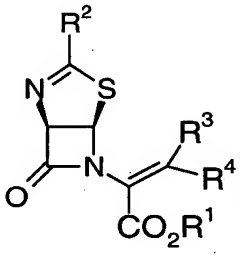
wherein R^2 is selected from the group consisting of C_{1-6}alkyl, C_{6-10}aryl, C_{6-10}aryl C_{1-6}alkyl and dithianyl; with a compound of formula **(IX)**



(IX)

wherein each of said L_1 and L_2 is a leaving group selected from the group consisting of halo, azide and C_{1-6}alkoxy; in a solvent, optionally in the presence of a base.

21. (ORIGINAL) A process according to claim 16 further comprising the step of preparing said compound of formula **(VIb)** comprising reacting a compound of formula **(VIc)**



(VIc)

wherein

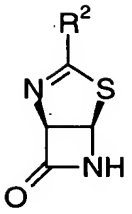
R^1 is *para*-nitrobenzyl or allyl;

R^2 is selected from the group consisting of C_{1-6}alkyl, C_{6-10}aryl, C_{6-10}arylC_{1-6}alkyl and dithianyl;

R^3 is hydrogen or C_{1-6}alkyl; and

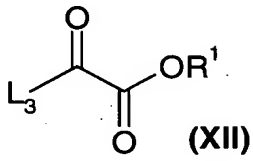
R^4 is hydrogen or C_{1-6}alkyl; with ozone, in a solvent.

22. (ORIGINAL) A process according to claim 16 further comprising the step of preparing said compound of formula **(VIb)** comprising reacting a compound of formula **(XI)**



(XI)

wherein R^2 is selected from the group consisting of C_{1-6}alkyl, C_{6-10}aryl, C_{6-10}aryl C_{1-6}alkyl, and dithianyl; with a compound of formula **(XII)**



(XII)

wherein

each of said L_3 is halo;

R^1 is *para*-nitrobenzyl or allyl;

in a solvent, in the presence of a base.

23. (ORIGINAL) A process according to claim 20, wherein each of L_1 and L_2, wherever each of them occurs, is halo selected from the group consisting of bromo or chloro.

24. (ORIGINAL) A process according to claim 21 wherein R^3 is methyl and R^4 is methyl.

25. (ORIGINAL) A process according to any of claims 7, 19-20 or 22 wherein said solvent, wherever it occurs, is methylene chloride, tetrahydrofuran or mixtures thereof.

26. (ORIGINAL) A process according to claim 21 wherein said solvent is methylene chloride, tetrahydrofuran, isopropanol or mixtures thereof.

27. (ORIGINAL) A process according to any of claims 19-21 wherein said base, wherever it occurs, is selected from the group consisting of diisopropylamine, triethylamine, pyridine and 2,6-lutidine.

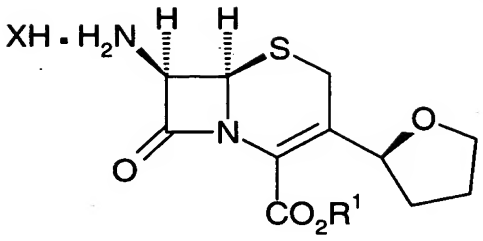
28. (ORIGINAL) A process according to any of claims 1-27, wherein each of said R^1, wherever it occurs, is *para*-nitrobenzyl.

29. (ORIGINAL) A process according to any of claims 1-27, wherein each of said R^1, wherever it occurs, is allyl.

30. (ORIGINAL) A process according to any of claims 1-27, wherein each of said R^2, wherever it occurs, is C_{6-10}arylC_{1-6}alkyl.

31. (ORIGINAL) A process according to any of claims 1-27, wherein each of said R^2, wherever it occurs, is benzyl.

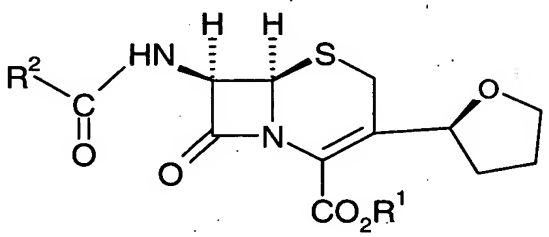
32. (ORIGINAL) A compound of formula **(I)**



(I)

wherein R^1 is *para*-nitrobenzyl or allyl; and X is halo.

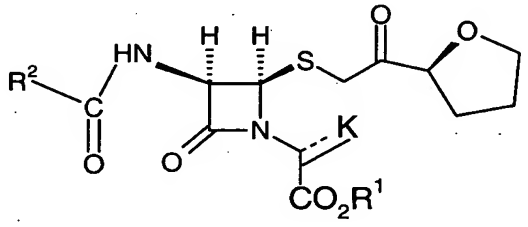
33. (ORIGINAL) A compound of formula **(II)**



(II)

wherein R^1 is *para*-nitrobenzyl or allyl; and R^2 is $(C_6\text{-}C_{10})$aryl$(C_{1\text{-}6})$alkyl.

34. (ORIGINAL) A compound of formula **(III)**



(III)

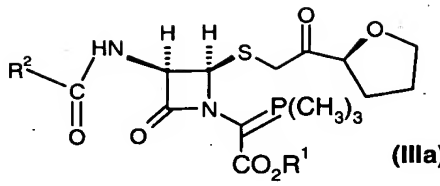
wherein R^1 is *para*-nitrobenzyl or allyl;

R^2 is $(C_6\text{-}C_{10})$aryl$(C_{1\text{-}6})$alkyl;

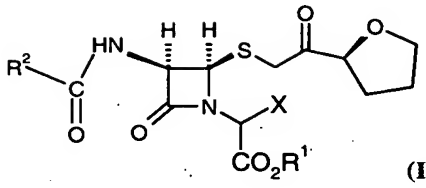
K is hydroxy, halo or -P-$(CH_3)_3$;

wherein the C-K bond is a single bond when K is hydroxy or halo; and a double bond when K is -P-$(CH_3)_3$; and

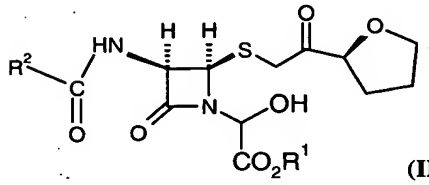
wherein said compound of formula **(III)** is selected from the group consisting of compound of formulae **(IIIa)**, **(IIIb)** and **(IIIc)**:



(IIIa) ;

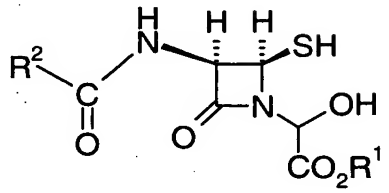


(IIIb) and



(IIIc) .

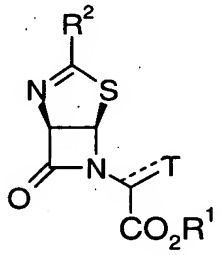
35. (ORIGINAL) A compound of formula (V)



(V)

wherein R^1 is *para*-nitrobenzyl or allyl; and R^2 is $(C_6\text{-}C_{10})$aryl$(C_{1\text{-}6})$alkyl.

36. (ORIGINAL) A compound of formula (VI)



(VI)

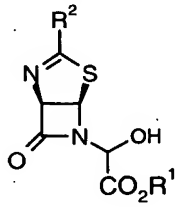
wherein R^1 is *para*-nitrobenzyl or allyl;

R^2 is $(C_6\text{-}C_{10})$aryl$(C_{1\text{-}6})$alkyl;

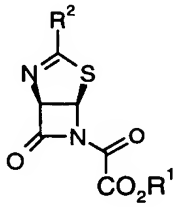
T is hydroxy or >O;

wherein the C-T bond is a single bond when T is hydroxy; and a double bond when T is >O ; and

wherein said compound of formula (VI) is selected from the group consisting of compound of formulae (VIa) and (VIb):



(VIa) and



(VIb)

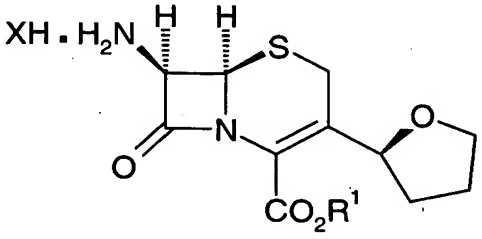
37. (CANCELLED)

38. (CANCELLED)

39. (CANCELLED)

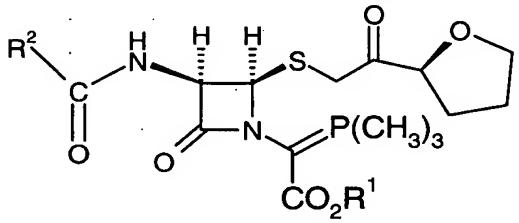
MARKED-UP COPY OF THE ABSTRACT OF THE INVENTION

This invention relates a process for preparing a compound of formula **(I)**



(I)

wherein R^1 is *para*-nitrobenzyl or allyl; preferably para-nitrobenzyl; ~~and~~ X is halo selected from the group consisting of bromo, chloro, fuloro and iodo, preferably chloro; by a) cyclizing a trimethylphosphinic compound of formula **(IIIa)**

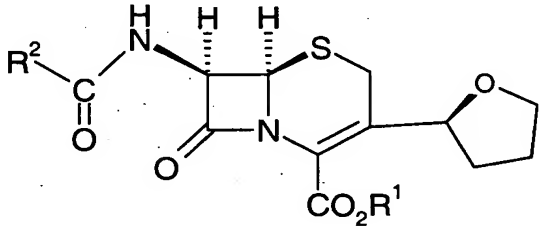


(IIIa)

wherein

R^1 is *para*-nitrobenzyl or allyl;

R^2 is selected from the group consisting of $C_{1\text{-}6}$alkyl, $C_{6\text{-}10}$aryl, $C_{6\text{-}10}$aryl$C_{1\text{-}6}$alkyl and dithianyl; in a solvent; to form a compound of formula **(II)**



(II)

wherein

R^1 is *para*-nitrobenzyl or allyl;

R^2 is selected from the group consisting of $C_{1\text{-}6}$alkyl, $C_{6\text{-}10}$aryl, $C_{6\text{-}10}$aryl$C_{1\text{-}6}$alkyl and dithianyl; and if desired

b) reacting said compound of formula **(II)** with a Lewis acid of structure PX_5 wherein X is a halo group. ~~which is useful to prepare 3-cyclic-ether substituted cephalosporins, from trimethylphosphinic compounds.~~ This invention also relates to compounds useful in such